From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

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TORONTO, ONTARIO M5H 3Y2
CANADA

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

T. Orsi
252

Date of mailing *(day/month/year)*	21.03.2002
Applicant's or agent's file reference: 45-36	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/CA01/00523	09/04/2001	19/05/2000

Applicant
MCMASTER UNIVERSITY ET AL.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Hopwood, S Tel.+49 89 2399-2429

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
45-36		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/CA01/00523	09/04/2001	19/05/2000
International Patent Classification (IPC) or national classification and IPC H01L29/15		
Applicant MCMASTER UNIVERSITY ET AL.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
18/12/2001	21.03.2002
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Madenach, A Telephone No. +49 89 2399 2832

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA01/00523

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-14	as originally filed			

Claims, No.:

1-8	as originally filed			
9-11	as received on	27/02/2002	with letter of	26/02/2002

Drawings, sheets:

1-5	as received on	11/06/2001	with letter of	11/06/2001

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

☐ the description, pages:

☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-11
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations
see separate sheet

The following comments relate to items II-VIII of the cover sheet where they have been crossed:

1. Reference is made to the following documents:

D1: HAYSOM J E ET AL: 'Quantum well intermixing caused by nonstoichiometric InP' CONFERENCE PROCEEDINGS. 2000 INTERNATIONAL CONFERENCE ON INDIUM PHOSPHIDE AND RELATED MATERIALS (CAT. NO.00CH37107), CONFERENCE PROCEEDINGS. 2000 INTERNATIONAL CONFERENCE ON INDIUM PHOSPHIDE AND RELATED MATERIALS, WILLIAMSBURG, VA, USA, 14-18 MAY 200, pages 56-59, XP002183000 2000, Piscataway, NJ, USA, IEEE, USA ISBN: 0-7803-6320-5

D2: RAMDANE A ET AL: 'MONOLITHIC INTEGRATION OF INGAASP-INP STRAINED-LAYER DISTRIBUTED FEEDBACK LASER AND EXTERNAL MODULATOR BY SELECTIVE QUANTUM-WELL INTERDIFFUSION' IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE INC. NEW YORK, US, vol. 7, no. 9, 1 September 1995 (1995-09-01), pages 1016-1018, XP000527505 ISSN: 1041-1135

D3: PINKNEY H ET AL: 'Growth of novel InP-based materials by He-plasma-assisted epitaxy' JOURNAL OF CRYSTAL GROWTH, NORTH-HOLLAND PUBLISHING CO. AMSTERDAM, NL, vol. 209, no. 2-3, February 2000 (2000-02), pages 237-241, XP004186681 ISSN: 0022-0248

D4: PINKNEY H ET AL: 'Characterization of annealed high-resistivity InP grown by He-plasma-assisted epitaxy' EIGHTH CANADIAN SEMICONDUCTOR TECHNOLOGY CONFERENCE, OTTAWA, ONT., CANADA, 12-15 AUG. 1997, vol. 16, no. 2, pages 772-775, XP002182415 Journal of Vacuum Science & Technology A (Vacuum, Surfaces, and Films), March-April 1998, AIP for American Vacuum Soc, USA ISSN: 0734-2101

D5: TSANG J S ET AL: 'Compositional disordering of InGaAs/GaAs heterostructures by low-temperature-grown GaAs layers' JOURNAL OF APPLIED PHYSICS, 15 JAN. 1996, AIP, USA, vol. 79, no. 2, pages 664-670, XP002182416 ISSN: 0021-8979

D6: MARSH J H ET AL: 'Quantum well intermixing in material systems for 1.5 mu m lasers' EIGHTH CANADIAN SEMICONDUCTOR TECHNOLOGY

CONFERENCE, OTTAWA, ONT., CANADA, 12-15 AUG. 1997, vol. 16, no. 2, pages 810-816, XP002182417 Journal of Vacuum Science & Technology A (Vacuum, Surfaces, and Films), March-April 1998, AIP for American Vacuum Soc, USA ISSN: 0734-2101

2. The present application meets the requirements of Article 33(2) and 33(3) PCT, because the subject-matter of claims **1-11** is novel and comprise an inventive step.

2.1 D1 and D2 appear to be the closest prior art showing a comparable process known as quantum well intermixing with only **one** type of top layer. D6 is also concerned with such a process. The effects of top layers with vacancy type defects and interstitial type are discussed.

2.2 None of the above papers discloses or suggests **two** top layers with different intermixing impurities as claimed. Double top layers solve the problem of obtaining a blueshift of the laser and a reduced carrier lifetime at the same time. Papers D1, D2 and D6 are primarily concerned with the blueshift.

2.3 A He-flux during growth for obtaining material with low carrier lifetimes is known from D3 and D4. These two papers, however, only discuss the effect on the such grown layers themselves. They do not suggest to apply this method to modify the lifetime in underlying quantum wells.

3.1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents **D1-D6** is not mentioned in the description, nor are these documents identified therein.

3.2 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

3.3 The Fig. 1 embodiment does no longer fall under the scope of the invention, nor do the devices as such. The description should have been adapted accordingly (Art. 6).

9. A method as defined in claim 8, wherein said deep states provide reduced carrier lifetimes within the bandgap of the Indium Gallium Arsenide Phosphide quantum well active region.

10. A method as defined in claim 9, wherein reduced carrier lifetimes provide a reduction in carrier recombination times within the bandgap of the Indium Gallium Arsenide Phosphide quantum well active region.

11. A method as defined in claim 8, wherein said deep states provide a mechanism for quenching photoluminescence within the Indium Gallium Arsenide Phosphide quantum well active region.